

New Refrigerants in BITZER Compressors

The new EU F-gas regulation contains a phase down schedule for F-gases, including HFC refrigerants, as a main tool to reduce the greenhouse warming impact. This leads to the replacement of existing refrigerants, having high GWP values, by new materials with lower GWP values, but similar or close thermodynamic behaviour.

Refrigerant mixtures (blends)

The new refrigerants are mostly mixtures of common HFCs (hydro fluoro carbons) and new materials like the unsaturated HFCs, also called HFOs (hydro fluoro olefins). Partly HCs (hydro carbons) are used in the mixtures.

The most low GWP refrigerant mixtures are having components appearing in table 1. The listed components are known and tested for compatibility by BITZER. For several refrigerants BITZER can deliver predicted performance data upon request.

Table 1: Common refrigerant mixture components

Type	Material	GWP	Group	Material compatibility	Oil
HFC	R32	675	A2L	known	known
	R125	3500	A1	known	known
	R134a	1430	A1	known	known
	R143a	4470	A2	known	known
	R152a	124	A2	known	known
HFC unsaturated	R1234yf	4	A2L	ok	ok
	R1234ze(E)	4	A2L	ok	ok
HC	R290	3	A3	known	known
	R600	3	A3	known	known
	R600a	3	A3	known	known

Products

If components listed in this table are used in the mixtures only, and the vapour pressure curves are not below this of R134a and not above this of R404A or R407F, the following product ranges of BITZER can be used in field test installations.

- ECOLINE: semihermetic reciprocating compressors / POE oil
- HS.: semihermetic screw compressors / POE oil
- CSH: semihermetic compact screw compressors / POE oil
- CSW: semihermetic compact screw compressors / POE oil

Application

Many new refrigerant mixtures, targeting replacement of R404A or R22, do have a significant temperature glide of 4 to 7 K during evaporation and condensation. This can,

depending on the system and heat exchanger design, lead to different evaporating and condensation temperatures than with e. g. R404A. Thus the operating conditions of the compressor can move, resulting in need for additional cooling earlier than expected from the comparison of theoretical data.

Application limits

Application limits for R134a, R404A, R407A and R407F can be found in the BITZER Software and in the product brochures.

The application limits of R134a can be used as a guide for refrigerants having similar pressure, e. g. R513A (XP10), R450A (N13), R1234yf. The application limits of R407A can be used as a guide for refrigerants with similar pressures as R404A or R407F, e. g. R448A (N40), R449A (XP40).

Additional limitations can appear due to discharge temperatures at high pressure ratio.

Flammability classification

If the refrigerant material or mixture to be used is listed as flammable – A3, A2 or A2L according to ASHRAE 34, ISO 817 resp. EN 378-1 – the system installation is to be made safe for the use of flammable refrigerants according to local regulations. For the compressors BITZER strongly recommends to place the motor protection device in the switchboard, not in the terminal box.

Inside the EU a risk assessment according to the ATEX directive is necessary. The preferred method to comply with regulations is to avoid a flammable concentration by appropriate measures. When planning the use of a flammable refrigerant, please contact BITZER.

Table 2: Flammability and GWP connections

Replace	GWP	T-glide	Group
R134a	550 .. 660	< 1 K	A1
	from 4 .. 150	0 K	A2L
R404A	1800 .. 2100 (w/o HFO)	< 7 K	A1
	1000 .. 1350	< 4 K	A1
	up to 300	?	A2L

Lubrication oil

Polyol ester oils (POE) are basically compatible to the new unsaturated refrigerant components. In field testing, oil sampling is recommended at commissioning and after 6 month of operation, to monitor acidity.